AUTOMATIC PRECIPITATION SAMPLER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention provides a means for automatically obtaining water samples from precipitation events which are to undergo analysis for trace chemical constituents. The sampler can operate unattended for long periods and collect multiple samples in sealed bottles of inert plastic. The time of sampling and duration of sampling are both recorded.

The importance of the physio-chemical analysis of rain and other forms of precipitation has become increasingly important as concern over atmospheric pollution mounts and techniques for measuring an ever increasing number of contaminants in smaller concentrations continue to be developed. As in all material analysis, the information is only as good as the quality of the collected sample and the information available from it. Consequently, as the information desired becomes more extensive and more affected by a greater number of variables, the sample collection procedure employed must of necessity become more sophisticated.

Collection of rain samples would appear to be a simple matter. However, the analyst is typically looking for constituents present in concentrations of parts per million or even less; hence, the collection equipment must be very clean and all surfaces which come in contact with the sample should be of relatively inert material which will not in itself be of a source of contamination.

The exact time of collection of the sample can be of importance in many studies since results can be related to meteoroligical data. The collection site may frequently be relatively inaccessible and it is often desirable to collect only the early part of an extended precipitation event since most of the contaminants which are scrubbed out of the atmosphere will be present in samples collected during the initial period. Consequently, a sampling device which operates automatically and which is capable of recording the time at which the sample was collected is very nearly essential. Concern over the harmful effects of pollution are resulting in an ever increasing number of legal actions; thus, the importance of a sound sampling system cannot be overstated when results of pollution studies are introduced as evidence in the courts.

Prior Art

Papers reporting on results obtained from physio-chemical analysis of rain samples have appeared at least as early as 1926. Thus, some means for collecting rain samples for analysis have been in use for at least 50 years. An evaluation of a number of precipitation samplers is contained in a paper by Galloway and Likens, 1975 Proc. 1st Internat. Symp. on Acid Precipitation and the Forest Ecosystem (1976).

A sampler developed by the Health and Safety Laboratory of the Atomic Energy Commission has provision for automatically uncovering a sample collection funnel at the onset of precipitation and closing it again when precipitation ceases. Thus, this sampler has some of the features cited as important in the context of todays sampling problem. It is, however, deficient on a number of points. Collection surfaces are of metal instead of inert material such as Teflon. There is no provision for collecting individual samples from separate precipitation events; for example, if the sample is not collected after each precipitation, the next event simply adds to water already present in the sample container. There is also no means for collecting a number of separate samples throughout an extended period of continued precipitation. The time of sample collection is not recorded making correlation with available meteorological data very tenuous. Finally, power requirements are relatively high thus requiring a sizeable power pack for unattended operation for long periods.

SUMMARY OF THE INVENTION

It is therefore a principal object of this invention to provide a sampler which is capable of collecting samples of precipitation in the "as fallen" condition for analysis of trace constituents.

It is a related object of the invention to provide a precipitation sampler which is fully automatic and capable of obtaining samples from a number of separate and distinct precipitation events or multiple samples from the same precipitation event completely unattended.

It is another object of the invention to incorporate an adjustable precipitation detector responsive to a predetermined rate of precipitation, i.e. which can discriminate between very light precipitation and more heavy precipitation and thereby to prevent sampling of the former, while permitting a sample of the latter to be collected.

It is still another object of the invention to include means for measuring and recording the chronological and/or lapsed time of one or more of the operations conducted by the apparatus; for example, time measuring means in the sample system which will measure the interval of time from loading empty storage means to initiation of collection of sample and the duration of sample collection; and to include with the time measuring means a recording means which permits retrieval of all time intervals and permits correlation with meteorological data.

Another object of the invention is to provide a precipitation sampler with a collector cover (to seal against dust, insects, pollen, molds, and other sources of contamination) which can be automatically removed when precipitation has commenced, i.e. when a predetermined amount of precipitation has been sensed, and automatically returned when it stops.

Still another object of the invention is to provide an automatic precipitation sampler which can operate unattended for long intervals using a self-contained power source such as a battery and/or compressed gas.

It is yet another object of the present invention to position the collector surface far enough above adjacent surfaces and away from the collector cover to preclude possibility of contamination from splash.

A further object of the invention is the incorporation of a detector funnel and collector surface which contain heating elements affixed to the under surface and which can be automatically energized, i.e., through a pre-set thermal switch, when temperatures dip low enough to cause precipitation to fall as snow.

Still another object of the invention is to provide a collection system in which all wetted surfaces, including sample storage means, are relatively inert to prevent contamination of collected samples.

In accordance with the objects cited above, a novel precipitation sampler is provided which contains an adjustable precipitation detector so designed that the sampler will function only in precipitation above a certain predetermined level of intensity, e.g., to collect or